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The Effect of University Education on Employment in the Visegrad Group

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Abstract

This thesis investigates the effect of university education on employability in the Visegrad group countries. Education as a part of human capital plays a relevant role in the labour economics. Data from the sixth round of the European Social Survey are applied to this research. The study is divided into three parts. The first part examines the impact of achieving a university degree on employability in the whole Visegrad region. The second part focuses on comparing the effect of completing university education across individual countries of the Visegrad region. The last third part studies the additional value of completing different levels of tertiary education. Results suggest that the correlation between the level of education and the probability of being employed is positive. Those who has completed university education have eighty-seven percent higher chance to be employed, in comparison with those who has completed only secondary education. The most significant difference in employability was detected in Poland and least significant in the Czech Republic. The impact of the additional level of tertiary education on the employability is higher but appears to be diminishing with higher degree.

Keywords

Higher education, Tertiary education, The Visegrad group, University, employment, Bachelor's degree, The Czech Republic, The Slovak Republic, Hungary, Poland

Abstrakt

Táto práca skúma vplyv vysokoškolského vzdelania na zamestnateľnosť v krajinách vyšehradskej skupiny. Vzdelanie ako súčasť ľudského kapitálu zohráva významnú úlohu v ekonomike práce. Tento výskum používa data získané zo šiesteho kola prieskumu the European Social Survey. Štúdia je rozdelená na tri časti. Prvá časť skúma vplyv univerzitného titulu na zamestnateľnosť v celej vyšehradskej skupine. Druhá časť sa zameriava na porovnanie efektu dosiahnutého univerzitného vzdelania v jednotlivých krajinách vyšehradskej skupiny. Posledná tretia časť skúma pridanú hodnotu dokončenia rôznych úrovní vysokoškolského vzdelania. Výsledky naznačujú, že medzi úrovňou vzdelania a pravdepodobnosťou byť zamestnaný je pozitívna korelácia. Jednotlivci, ktorí dokončili univerzitné vzdelanie majú o osemdesiatsedem percent vyššiu šancu byť zamestnaný ako tí, ktorí dosiahli iba stredoškolské vzdelanie. Najvýraznejší rozdiel v zamestnateľnosti bol zaznamenaný v Poľsku a naopak najmenej výrazný v Českej republike. Vplyv dodatočnej dokončenej úrovne vysokoškolského vzdelania je vyšší, ale klesajúci s vyšším stupňom vzdelania.

Kľúčové slová

Vyššie vzdelanie, univerzitné vzdelanie, vyšehradská štvorka, univerzita, zamestnateľnosť , bakalársky titul, Česká republika, Slovenská republika, Maďarsko, Poľsko

Declaration of Authorship

I hereby proclaim that I wrote my bachelor thesis on my own under the leadership of my supervisor and that the references include all resources and literature I have used.

I grant a permission to reproduce and to distribute copies of this thesis document in whole or in part.

Prague, 24 July 2018

Signature

Acknowledgment

I would like to express my gratitude to my supervisor, doc. Ing Tomáš Cahlík CSc. for his time, expertise and valuable comments, further to Bc. Jana Holková and Bc. Peter Kúdeľa for their advice and motivation.

Bachelor's Thesis Proposal

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Notes: Please enter the information from the proposal to the Student Information System (SIS) and submit the proposal signed by yourself and by the supervisor to the Academic Director ("garant") of the undergraduate program.

Proposed Topic:

The Effect of the University Education on the Employment in the Visegrad Group

Preliminary scope of work:

Research question and motivation

The value of university education can be understood in many ways. In this research, main subject of our investigation is the effect of a university degree on employability in the Visegrad group countries. The dependent variable is the variable employment. An individual is considered to be employed if during the last seven days before taking a survey, worked in a paid work either as an employee or self-employed or worked for a family business. In recent years, a great deal of research considering this topic have been published, showing that the level of education is positively correlated with the probability of being employed. Nowadays, it has become an even more popular field for investigation, as plenty of analyses try to crack the problem of correct model specification. My goal is to define the impact of university education in the Visegrad group countries and show whether it is beneficial to achieve additional education.

Contribution

The intuition behind my thesis is to supplement the existing literature with the conditions and impact of education within the examined countries. I plan to estimate the logit model. Based on the results of the regression I am going to make a conclusion about how big are benefits from studying at the university for the indiviuduals in the Visegrad group countries and additionally investigate the difference between completing Bachelor's degree and Master's degree.

Methodology

I am going to divide my research into three parts. The first part studies the relationship between a dependent variable (employment) and an independent variable (degree of education). I will obtain data from the sixth round of the European Social Survey (ESS), which was conducted in 2012. Based on these data, the maximum likelihood estimation of logit model will be conducted. To interpret logit regression, both the log-odds interpretation and the average marginal effect interpretation are used. Additionally, the linear probability model is included mainly to compare results obtained from the logit regression and corresponding AME estimates. The results of the regression will help me to define the answer to my question. The main interest of the second part is to compare the effect of achieving a university degree across individual countries of the Visegrad region; and the last third part investigates the additional value of completing Master's degree instead of Bachelor's degree

Outline

1. Theory about education and its value
2. Literature review
3. Data and variables
4. Econometric models analyses
5. Empirical results
6. Conclusion
7. References

List of academic literature:

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Author **Supervisor**

Contents

Introduction

Education plays a very important part in human capital development. According to Adedeji and Campbell (2013), an investing into higher education has developed into one of the most important investments in the twenty-first century, not only for individuals but also for the economy of a country. As a consequence of possible national productivity boost, higher education increases the competitive advantage of countries (Porter, 1990).

Early supporters of the human capital theory claimed that the ability of individual to face and solve problems under the pressure, as well as to make the right decision under changing circumstances, is positively correlated with investment into education.

In contrast with lower level of education, the higher education has always been associated with higher chance of finding a job (OECD, 2017). University education generally leads to collection of human capital, which relates to higher productivity. Companies are committed to constantly maintaining a high level of productivity, so they would not be willing to dismiss high-skilled employees. In addition, The Signalling Theory (Spence, 1978) explains that graduates have certain natural born abilities which help them to achieve their university degrees. Higher education might, therefore, be a hallmark of such skills, and companies thus have a greater incentive to recruit such workers compared to workers without tertiary education.

According to OECD (2017), returns on higher education are not only in finding a better job or income improvement but also in improving a general health condition of an individual, as well as in the development of subjective satisfaction with life.

Looking at the previous empirical evidence, there is an absence of research which investigates the relationship between the level of education and the probability of being employed, especially in the Visegrad group countries.

As a result of such research, the government of examined countries is able to evaluate whether policies made toward the education system are accurate, or whether the education system functions properly and if additional government interventions should be implemented. Analysing the behaviour of higher education graduates is also crucial for the assessment of policy options affecting the labour market.

This paper follows various researches (For instance, Nunez and Livanos (2010), Lauer (2003), Oancea et al. (2016)) which were interested in the impact of higher education on short-term as well as long-term unemployment across Europe. The interest of our investigation is only in short-term unemployment in the specific area of the Visegrad region.

The study is divided into several parts. The first part examines the impact of achieving a university degree in the whole Visegrad region. The second part concentrates on country specific models. The main interest of this part is to compare the effect of achieving a university degree across individual countries of the Visegrad region. The last third part, examines the difference in the effect of the existence of two separate levels of tertiary education. The model compares the completion of a Bachelor's degree (three to four years of education) with a Master's degree (also includes doctoral degree).

All of these models contain a binary dependent variable (*employment*). Therefore, logistic (logit) regression is applied. The conclusion from all regressions is reached using the Maximum Likelihood Estimation (MLE). To interpret logit regression, both the log-odds interpretation and the average marginal effect interpretation are used.

The data for this investigation are obtained from the sixth round of the European Social Survey (ESS), which took place in 2012. The random sample is achieved by using appropriate weighting techniques.

The results from the first model show that an individual who has completed higher education has an 87 percent higher chance of success in finding a job, compared to a person with only secondary education. This relationship is studied in more detail in the third model where higher education is divided into the Bachelor's degree and Master's degree. The results are significant and indicate that a person with Bachelor's degree has a 79 percent higher chance of being employed, and a person with a Master's degree has a 93 percent higher chance of being employed compared to a person who has only completed secondary education.

In the second model, we estimate each country by itself to see the national effect of university education. The most significant effect of higher education is observed in Poland, and the smallest effect is in the Czech Republic. These differences can be caused by various reasons, while the most intuitive argument for an explanation of the impact not being significant in the Czech Republic may be linked with the very low unemployment rate (OECD, 2018). Demand on the labour market is smaller, and therefore, it is harder to find a job. Another important point to mention is that the employment rate varies across fields of study (OECD, 2017). Hence the performance of a country might be weakened by the fact that there exist a surplus of individuals who graduated in a field which is not so popular in the labour market (Abel et al., 2014).

The structure of the thesis is the following: firstly the current economic situation in the Visegrad countries is described with a focus on employment and education. Secondly, the already existing literature is summarized in Chapter 2. Then in Chapter 3 and Chapter 4 are introduced data and methodology, and in Chapter 5 are presented the results of the investigation. In the last chapter, the inference of the whole thesis is summarized.

Chapter 1

The employment and education in the Visegrad region

The countries of the Visegrad region have similar policies towards education. Almost all Visegrad countries have tertiary education free of charge. This rule is not valid for Hungary, where students have to pay tuition fees. However, the Hungarian government offers a scholarship program, where the majority of students receive a scholarship and are exempt from tuition fees. This scholarship is allocated based on student's results.

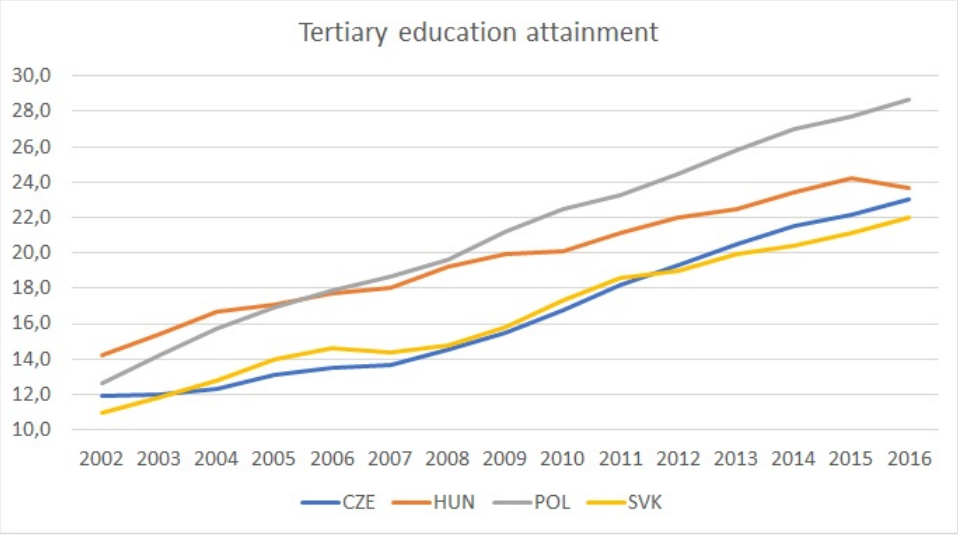

Figure 1.1: The development of the tertiary education attainment in the Visegrad group countries (OECD, 2017).

Figure 1.1 clearly shows that the interest in tertiary education has been steadily increasing in the last fourteen years in all four countries of the Visegrad region. Education is more and more available to students due to various factors (for instance, the higher number of universities or studying without tuition fees). This has resulted in significant increase in the number of graduates especially between 25-64 years of age (OECD, 2017).

According to OECD (*Who are the bachelor's and master's graduates?*, 2016), the number of both Bachelor's and Master's graduates in the OECD countries as well as in the countries of the Visegrad group has increased significantly in recent decades. This leads to an increase in number of highly qualified workers entering the labour market, which could result in higher competition among these workers, and make the task of finding the right job more challenging. For instance, by investigating the rising trend of unemployed graduates in most European countries, Moreau and Leathwood (2006) have predicted that this trend will be rather continuous.

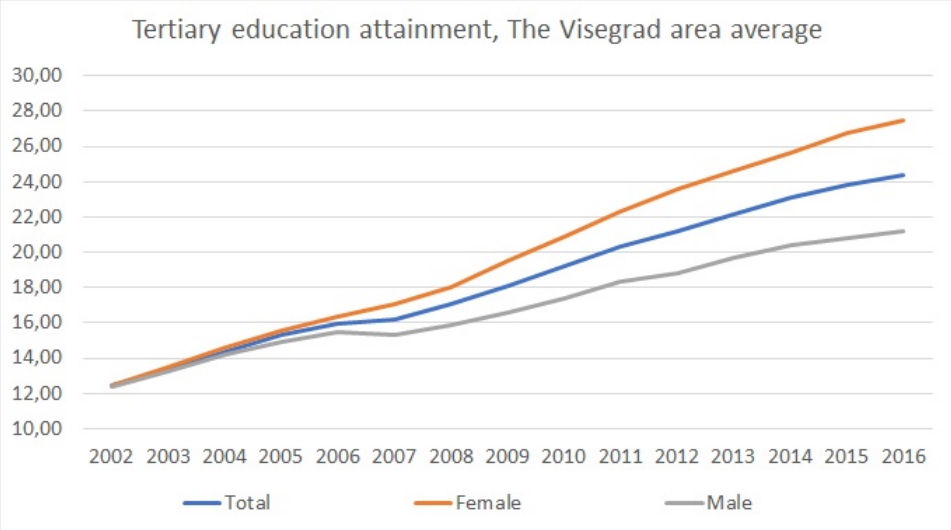

Figure 1.2: The development of the tertiary education attainment at the Visegrad region average (OECD, 2017).

Considering data for the Visegrad group (Figure 1.2), women attainment in tertiary education has risen more quickly compared to men attainment.

The chosen field of study is an important factor connected with a better

position in the labor market. Some fields have a better employment rate than others. For instance, from the data provided by the OECD *Fields of education, gender and the labour market* (2016), education sciences and social sciences have a lower employment rate in the long run compared, for example, to engineering and technical sciences or medical sciences.

According to OECD (2017), the most popular fields of study[1] in Poland, Hungary, and the Czech Republic are arts and humanities, social sciences, journalism, and information technology. In the Slovak Republic, the most popular fields of study are engineering, manufacturing, and construction, followed by studying education sciences, business, and law.

Gender equality has been achieved in many fields of study, albeit in some study fields, there are still significant gender differences between men and women. For instance, mathematics or engineering are still dominant for men, unlike medical or pedagogical sciences, which are dominant for women. Social sciences and services are those where gender inequality is negligible (*Fields of education, gender and the labour market*, 2016).

Figure 1.3 below shows that in 2012, approximately 15 percent more men were employed compared to women. This fact can suggest an occurrence of gender inequality in the Visegrad labour market, implying that gender, as well as education, might have an effect on the probability of finding a job. Bakas and Papapetrou (2014) proved this theory in their paper (*Unemployment by Gender: Evidence from EU countries*).

In the last fourteen years, the employment to population ratio increased, with the exception of the period between 2008 and 2010, when a significant drop was recorded. This drop was caused mainly by the global financial crisis, which consequences did not miss the Visegrad region.

The intuition of the positive impact of higher education can be supported by the positive linear relationship between the increase in tertiary education, noticeable in Figure 1.1, and an increase in the employment to population ratio in Figure 1.3

[1]In Appendix A is available table *Distribution of people who completed tertiary education by fields of study*

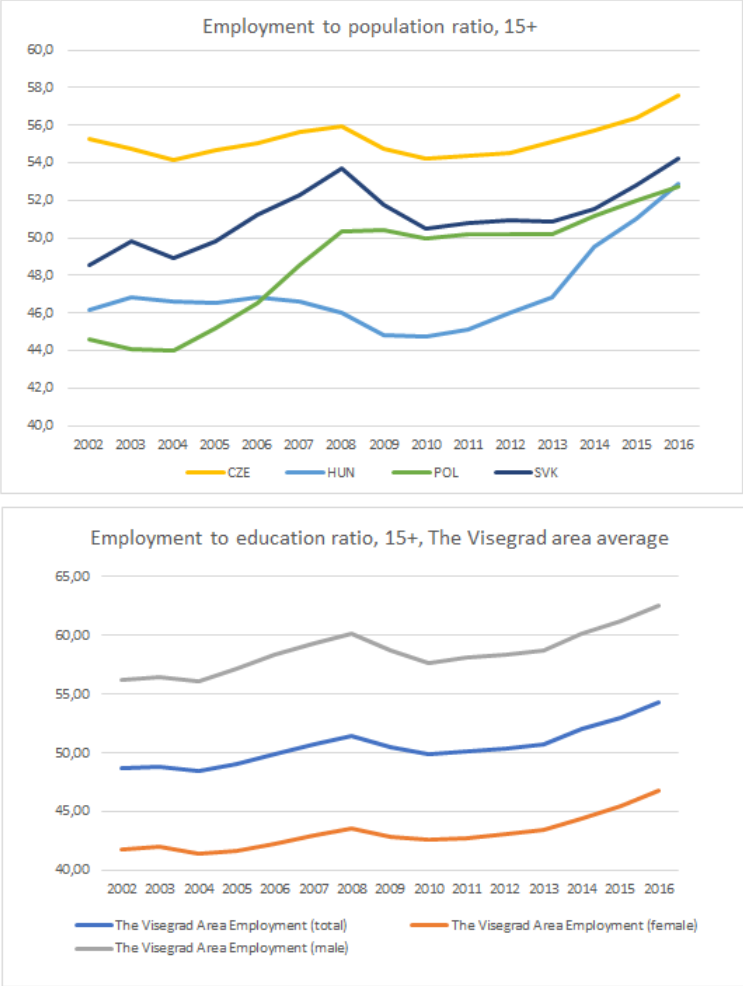

Figure 1.3: The development of the employment to population ratio in the Visegrad group countries (OECD, 2017).

According to OECD (2017), the probability of being employed is positively correlated with the level of education. The OECD employment rate average is approximately 85 percent for people between 25-64 years of age who achieved tertiary education, 75 percent for adults with upper secondary education (post-secondary education), and only less than 60 percent for adults whose education level is below upper-secondary level.

The positive correlation between the level of education and the employment rate can be demonstrated by the Figure 1.4, which represents adults between 25-64 years of age living in the Visegrad area.

In countries of the Visegrad area, one of the highest differences between

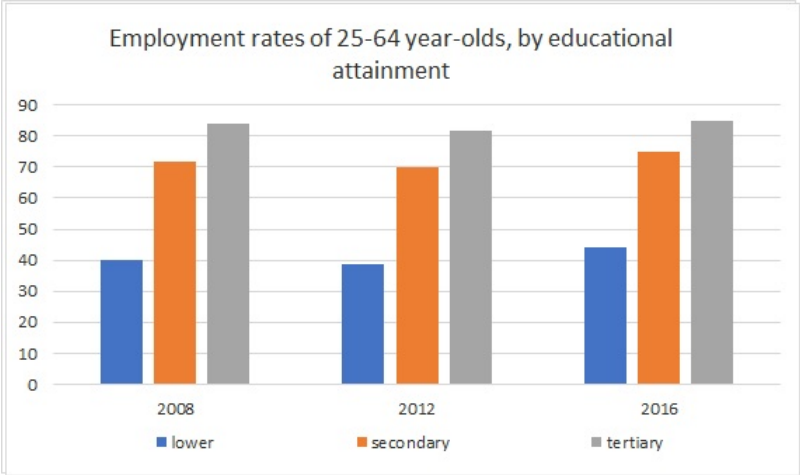

Figure 1.4: Employment rates of individuals between 25-64 years of age, by the level of education in the Visegrad region (OECD, 2017).

adults with completed upper-secondary education and adults who were not able to complete upper-secondary education in the likelihood of being employed was recorded. In all countries, employment rates are more than 25 percentage points greater for individuals who achieved upper-secondary education. Either upper-secondary or post-secondary (not tertiary) education became a threshold for successful entry into the labour market in the past years (*What are the advantages today of having an upper secondary qualification?*, 2015).

The difference between achieving tertiary education and achieving upper secondary or post-secondary education is not so remarkable. However, in Poland, with about 20 percentage points, this difference is one one of the highest across the OECD countries; in the Slovak Republic and Hungary, the additional value of obtaining a tertiary education is similar. It is approximately 9 percent for the Slovak Republic and 7 percent for Hungary. The Czech Republic shows the lowest difference between the effect of tertiary education and the effect of either upper-secondary or post-secondary education in the countries of the Visegrad region, while it only reaches as low as 5 percent. (OECD, 2017).

Government policies within the country are important to support the education system to be equally accessible, as well as to maintain the highest

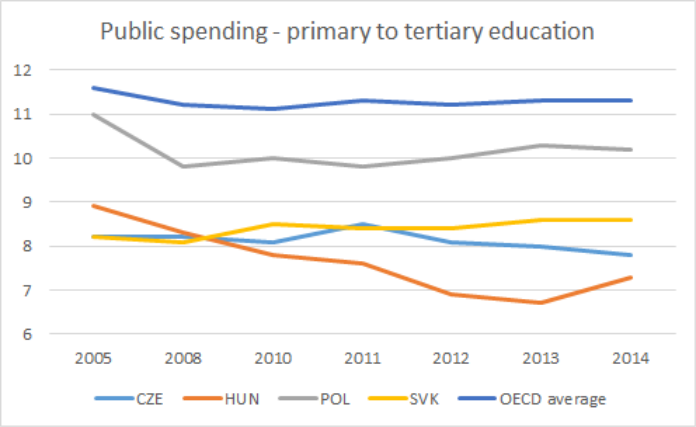

Figure 1.5: Direct public expenditure on educational system plus public subsidies to households and other private entities as a percentage of total government expenditure (OECD, 2017).

possible standard. Public spending may be an indicator of the country's interest in educational institutions. Public expenditure on education as a share of all public spending is lower in all four examined countries compared to the OECD average (OECD, 2017).

With regard to the OECD (2017), the largest amount of money spent on education is in Poland, not only for spending on primary to tertiary education but also when considering spending on a tertiary education separately (2.8 percent). Poland also has the highest difference between employment rate of upper secondary educated individuals and university educated individuals. The link between these two statistics can suggest possible correlation between public spending on education and the employability of university graduates.

Chapter 2

Literature review

The lower incidence of unemployment among people who accomplished higher education is considered to be a well-established phenomenon. Many researchers have been devoted to the relationship between the achieved level of education and the unemployment rate. Literary sources provide us with two frequent approaches referring to this phenomenon, one focusing on investigating the relationship between education and the occurrence of unemployment, and the other one based on finding correlations between the duration of labour seeking process and the level of education.

One of the first researches about this topic was introduced by Nickell (1979), whose analysis was based on studying how the level of education may influence the probability of being unemployed at a given time, and the effect of education on the length of unemployment. The results were derived from the data based on the survey conducted in Great Britain and show that there exists a negative correlation between the level of education and the probability of being unemployed (Nickell, 1979)

Following Nickell's research, Mincer (1991) focused on exploring the relationship between education and unemployment, for both men and women, using a different methodology. Firstly, the author divides the unemployment rate into various components. Secondly, he observes multiple effects of all educational levels on gross unemployment by identifying divergences within various components further attempts to analyse the impact of the level of

education on employability, clear of other characteristics from his observations. The analysis of Mincer (1991) findings indicates that the lower unemployment incidence of workers with completed higher education is, in approximately equal amount caused by both their more remarkable connection to the companies employing them, and the lower uncertainty of becoming unemployed when they are isolated from the firm.

According to Ashenfelter and Ham (1979), there is no significant link between education and the duration of unemployment spells[1]. Based on data of 799 white males drawn from the University of Michigan Income Dynamics Survey (IDS) the authors concluded that with longer time spent on schooling, the probability of unemployment incidence decreases.

Kiefer (1985) applied ordinary least squares (OLS) regression in order to analyse the position of the education level in the case of labour turnover. Data from the Denver Income Maintenance Experiment were used to confirm his hypothesis. Kiefer (1985) successfully demonstrated significant negative correlation between the level of education and the duration of unemployment.

Another researcher, Kettunen (1997) substituted the explanatory variable 'level of education' with variable 'years of education', and examined its impact on the re-employment probability by using Finnish data. Results of the search model conducted by Kettunen (1997) show that those who have spent more years in education, lower a probability of being re-employed, which is due to the positive effect of years of education on the reservation utility[2]. Kettunen (1997) also stated that the probability of accepting a new job offer decreases with the increasing reservation utility, and subsequently identified an optimal amount of years of education which maximise the probability of

[1] Unemployment spell is defined an uninterrupted period of months in which an individual was unemployed. According to an article, How is unemployment measured and what are different types of unemployment? Also, what are the economic disadvantages associated with high employment? Available from: `https://www.frbsf.org/education/publications/doctor-econ/2007/may/unemployment-employment-disadvantages-types/`

[2] A reservation utility is defined as the minimum level of utility that must be guaranteed by a contract to make it acceptable to an agent. According to *Reservation utility*, BLACK, John; HASHIMZADE, Nigar; MYLES, Gareth (ed.). A dictionary of economics. OUP Oxford, 2012.

re-employment[3]. He concluded that people with 13-14 years of education have the highest probability of re-employment.

Bratberg and Nilsen (1998) studied the period of time which graduates spend on finding a job as well as the duration of a first paid job. Whole research is based on Norwegian individuals graduating between 1989 and 1991. The inference of their investigation is achieved by applying a system of simultaneous equations, and refers to the importance of education in case of the shorter job search duration alongside longer first job duration. which are undoubtedly connected with the higher educated individuals. With their conclusions, Bratberg and Nilsen (1998) tried to support the decision the Norwegian government was making about increasing investments into education.

During investigation of the impact of a college degree on the sheepskin effect[4], Jaeger and Page (1996) discovered differences in the effects of various degrees on the employability of individuals. Their main focus was the associate's degree[5] and bachelor's degree. Summarizing that signalling of a university degree varies due to the type of a diploma.

Wolbers (2000) argues that employers prefer higher educated workers for jobs which were previously meant workers who had achieved the lower level of education. Therefore, the unemployment incidence of less educated workers increases over time. Wolbers (2000) examined an empirical research of the mentioned phenomena, considering the Dutch panel data in the period between 1980-1994. The examination proves that signalling of education is robust, first who get fired are more likely to be the lower educated workers; they also have worse prospects for ending unemployment. Nevertheless,

[3]Re-employment is the act or an instance of employing or being employed again. According to *re-employment*, available from: `https://www.collinsdictionary.com/dictionary/english/re-employment`

[4]The sheepskin effect is the hypothesis that the achieving of an educational degree would yield a higher income than the same amount of studying without possession of a degree. Source: Belman, D., & Heywood, J. (1991). Sheepskin Effects in the Returns to Education: An Examination of Women and Minorities. The Review of Economics and Statistics, 73(4), 720-724. doi:10.2307/2109413

[5]An associate degree is a college degree that is awarded to a student who has completed a two-year course of study. According to *associate degree*, available from: `https://www.collinsdictionary.com/dictionary/english/associate-degree`

the connection between education and unemployment is not entirely linear. Individuals with higher vocational education[6] are facing a lower risk of experiencing unemployment in comparison with the university educated individuals.

The impact of both the education and demographic effects on unemployment is studied in the research of Biagi and Lucifora (2008) in ten European countries. By operating with a panel data between 1975 and 2002, they found that a significant part of the variation in unemployment rates is caused by transition in the population age along with the educational changes. Biagi and Lucifora (2008) also stated that the variation in population age notably influences the unemployment rate of lower-aged workers. Changes in the level of the education are negatively related to the unemployment rate of who have achieved higher levels of education. For a more appropriate description of fluctuations in the unemployment rate, Biagi and Lucifora (2008) also investigated the institutional effects. They declared that there are various approaches of labour market institutions which could affect the unemployment rate. The impact of employment protection is found to have a diminishing effect on the unemployment, and on the other hand, unemployment benefits are considered to contribute to unemployment.

Recently, the effect of a university degree on short-term and long-term unemployment was presented by Nunez and Livanos (2010). In their thorough analysis, they focused not only on the university degree but also on different fields of study of individuals across Europe (EU15). They processed the Labour Force Survey (LFS) data of over half a million individuals. The first part of their research is concerned with the university degree effect. They divided individuals into three groups by the level of education: low educated, medium (secondary) educated and high (tertiary) educated. The second part of their study focuses on a nation specific effect on the unemployment, and in the third part, their objective was to investigate the effect

[6]Educational training that provides practical experience in a particular occupational field, as agriculture, home economics, or industry. According to *Vocational education* Dictionary.com [online]. [Accessed 6 April 2018]. Available from:`http://www.dictionary.com/browse/vocational-education`

of the selected field of study on unemployment. The multinomial logistic regression model is used in their analysis of the obtained data. The results indicate that individuals with an academic degree have lower chances to be both short-term and long-term unemployed. Despite very comparable effects of all fields of study, a medicine, an engineering and an education science predict the highest chances of being employed according to obtained results.

Geographically oriented research with similar methodology was conducted by Oancea et al. (2016), while the country of their interest was Romania. Using the logit model, the authors estimated both the casual effect of an academic degree, and the effect of fields of study on unemployment. Because of the large amounf of data, which were obtained from the Population and Housing Census (2011), Oancea et al. had to treat their data with special techniques appropriate for the analysis of large amounts of data. The examination shows that individuals who have accomplished tertiary education have a significantly higher opportunity to find a job compared to others. Furthermore, the results indicate that the impact of achieving the tertiary level of education is greater in Romania compared to the other EU countries.

Lauer (2003) compared the French and German labour markets by analysing the link between the level of education and unemployment. The possibility of becoming unemployed and the possibility of not being re-employed are two separate subjects of the research. The inference was achieved by applying the hazard rate model. The results refer to higher unemployment endurance in Germany in comparison with France. Greater advantage in entering the labour market was noted with French university-educated workers, while on the other hand, the job stability is better for German workers, mainly due to better consistency of the German vocational education system. Lauer concluded that this result might be one of the reasons why a higher percentage of German people focus on finishing vocational qualification, whereas French individuals aim more for the access to higher education.

Becker (2006) adopted this issue in a very interesting way; she defined university education as a time-consuming process which can potentially lead

to a drop-out. On an empirical example from Italy, she identified that about 60 percent of all students fail before achieving a degree. In her paper, she modelled a trade-off between entering tertiary education and entering the employment right after graduating from high school. The model explains changes between education, employment, and unemployment. Based on this model, she stated that attending university is reasonable in case of an absence of job opportunities after completing high school. However, completing university education leads to a better position in the labour market.

Using the evidence from U.S., Riddell and Song (2011) investigated a return on education and its effect on the unemployment incidence and the success of re-employment. Human capital theory understands additional education as an investment, while the intention of Riddell and Song (2011) was to confirm that this investment would improve the position of an individual in the labour market. The results show a negative effect of education on unemployment incidence and a positive effect on the success of re-employment. The strongest impact on the unemployment is associated with twelve and sixteen years of education, which indicates that the relationship is not completely linear. According to the obtained estimates, an extra year of education increases the probability of re-employment by approximately 4.7 percent, and achieving a university degree increases this probability by around 40 percent, confirming the advantage of investment into human capital.

Marginson (2016) stated in his book that not only knowledge but also confidence, creativity, or student's agency are being maximized during higher education. A growth in such abilities implies an increase in human capital, which is linked with higher productivity. Therefore, the demand for university-educated population is higher. Due to data between the years 2000 and 2010, Marginson (2016) claims that tertiary education not only gives a better chance of social assurance in terms of the lower unemployment rate, but also provides higher income protection.

Graduates often endeavour to find a job that is relevant to their achieved level of education Abel et al. (2014). studied whether this phenomenon increased over the past years. Based on their analysis, the researchers argue that the transition of new graduates into the labour market takes some time. Therefore, relatively high unemployment rates and underemployment rates are connected with recent graduates. On the other hand, the labour market became much more challenging for young adults without the university degree, compared to those who have completed their university studies. Abel et al. suggest that the right choice of the field of study is what matters. Such fields as engineering, math and computing, or health sciences tend to have lower unemployment rates than those fields which provide less technical training and focus more on general training.

In the Visegrad countries, several previous researches have analysed fluctuations in the unemployment rate. However, no evidence about returns to education in case of being unemployed is to be found. This thesis should contribute to the field of research on the relationship between the level of education and employability in the Visegrad group countries.

Chapter 3

Data

This paper processes a micro-data obtained from the sixth round of the European Social Survey (ESS) which has been conducted every two years since foundation in 2001. The ESS is an academically managed cross-country survey. Personal interviews are used to measure behavioural patterns as well as expectations of individuals from Europe. The size of the sample varies across countries.

This study specializes in countries of the Visegrad group. Therefore, data for the Czech Republic, the Slovak Republic, Hungary, and Poland are selected from the sample. Altogether set of 7412 observations focusing on the set from the age of fifteen years is being examined. The sixth round of the ESS took place in 2012 and the final version was released on December 1st, 2016. It was the last round in which all four Visegrad countries participated. This is the main reason why this article concentrates on this round.

For Maximum Likelihood Estimation (MLE) to be consistent, asymptotically efficient and asymptotically normal estimation function, it is very important to obtain a random sample (Wooldridge, 2015). However, surveyed respondents have diverse chance to be part of a sample, implying that the assumption of a random sample may be violated. To correct this problem, the ESS uses probability-based samples, where every respondent has a non-zero probability of being included in a surveyed sample. For more reliable analysis is the weighting of data necessary. Using post-stratification

weights (pspwght) jointly with population size weights (pweights) would make our sample random and qualified to use. Post-stratification weights use the supplementary information about age-group, gender, education, and region to diminish sampling error. The population size weights vary only across countries not across individuals within a country. These weights deal with a possible sample bias caused by an excessive representation of smaller countries to the disadvantage the larger countries and are used only for multiple countries regressions.

The research analyses the effect of a university degree on the employment status in three models. The dependent variable employment is same for all models and list of explanatory variables varies in each model. The *employment* as a dependent variable identifies the short-term employment status of an individual. An individual is considered to be employed if during the last seven days before taking a survey, worked in a paid work either as an employee or self-employed or worked for a family business. All the variables are dummy variables thus their mean values represent their percentage presence in the sample.

The level of education is a variable on which this paper concentrates the most. Using the country-specific variables where individuals answered for the highest obtained level of education, the level of education is divided into three groups.: *university education* (completed tertiary education), *secondary education* (completed secondary education, vocational school or technical school) and *lower education* (completed primary education, unfinished secondary education). For the further investigation of the concrete level of university education, the university education is divided into two variables based on The International Standard Classification of Education (ISCED, 1997): *Bachelor's degree* (ISCED 6) and *Master's degree* including also doctoral degree (ISCED 7). Variables *CZ, SK, PL, HU* were created to illustrate a national effect on the employability. In the case of gender discrimination incidence in the labour market, the variable *male* is encompassed. Age of all individuals is divided into five age groups by ten years: *15-24, 25-34, 35-44,*

45-54, 55+. Variable *minor* is introduced with the aim to capture how a minority ethnic group in a country affects the employability. Area of living where an individual lives is determined by three variables: *big city, town* (including also suburbs), *village* (including also countryside). The observed sample also includes people who are at home doing either housework or looking after children or looking after other people as well as people who are retired or students. One of the shared characteristics of all these groups of people may be that they are unwilling to participate in paid work as strongly as other surveyed individuals. For this reason, the control variables, *student, retired and house* are introduced. The last variable is *live_partner* and it specifies if the individual lived with a husband, wife or a partner in the same household at the time of the survey.

Chapter 4

Methodology

As was mentioned in the Introduction, this paper divides the study of the effect of a university education on employability into three models. In all three models, the dependent variable *(employment)* is a binary variable for which holds that positive outcome equals to one when an individual is employed (as was defined in the chapter Data) and negative outcome equals to zero when the individual did not perform paid work in last seven days. As a result of the binary dependent variable, binary response models are applied for the estimation. This paper operates with the logistic (logit) regression. Logit regression uses the logistic function ($\Lambda(z) = exp(z)/1 + exp(z)$) in order to maintain the fitted probabilities of the model in the open interval $\langle 0,1 \rangle$ (Wooldridge, 2015). Additionally, the linear probability model (LPM) is used to compare and verify results from the logistic regression.

To obtain estimators of a non-linear regression, the Maximum Likelihood Estimation (MLE) is introduced. In the chapter Data, we stated that under very generic assumption, obtaining a random sample is enough to claim that the MLE is consistent, asymptotically normal and asymptotically efficient (Wooldridge, 2015). Due to weighting the data, an assumption for the random sample is satisfied. Therefore, we can derive asymptotic standard errors and use them to test hypotheses. The LPM model operates with the ordinary least squares estimation (OLS). Due to the binary nature of the dependent variable, the LPM violates one of the Gauss-Markov assumptions,

implying the occurrence of heteroskedasticity. Robust standard errors are used to account for heteroskedasticity. Thanks to sufficiently large sample, estimators of LPM are asymptotically consistent if a correlation between independent variables and disturbances is equal to zero (Wooldridge, 2015).

The Likelihood Ratio (LR) test is used to determine whether our variables are significant or not. If the log-likelihood drops significantly due to the exclusion of some variable from the model, we can safely assert that this variable is significant for the model (Wooldridge, 2015).

The non-linear nature of the logit regression indicates that interpretation of estimates is not as straightforward as in case of linear regression. We use two different methods to evaluate the logit regression results.

The most natural interpretation of logit model is using the odds ratio (relative chance to success = $P_i/1 - P_i$). This method is derived[1] from the definition of logistic function. It is very important to remind that the coefficients measure the percentage change in the chances of success, which means that the increase in the probability of employment from five percent to ten percent in one country is illustrated with the same coefficient as an increase from one percent to two percent in another country. Log-odds estimates obtained from our regressions represent a percentage change in the chance of success that an individual is employed.

The second method of interpreting a logistic regression is demonstrating the impact of the university degree on employability through marginal effects. Because of dummy variables, that have discrete values, the interpretation of average marginal effect is more preferred than the marginal effect at average interpretation. According to Wooldridge (2015) an average marginal effect compares marginal effects based on two hypothetical populations. In the first population, all individuals received a university degree and in the second, none achieved a university degree. By calculating the average of all these marginal effects, we get the average marginal effect. The problem with this method is that the probability of being employed varies according to many characteristics of the person. For instance, the impact of a uni-

[1]Detailed derivation is shown in Appendix B

versity degree may differ considerably among younger people compared to older people and the average marginal effect can not reflect this difference.

4.1 Model specification

4.1.1 The effect of a university degree in the Visegrad region

Based on the mentioned methodology, data provided and previous literature, the following model is presented:

$$\begin{aligned} P(employment) = \Lambda(&\beta_0 + \beta_1 university\_education + \beta_2 lower\_education \\ &+ \beta_3 CZ + \beta_4 SK + \beta_5 PL + \beta_6 age\_15\text{–}24 + \beta_7 age\_25\text{–}34 \\ &+ \beta_8 age\_35\text{–}44 + \beta_9 age\_55plus + \beta_{10} student + \beta_{11} retired \\ &+ \beta_{12} house + \beta_{13} male + \beta_{14} minor + \beta_{15} big\_city + \beta_{16} village \\ &+ \beta_{17} live\_partner + u) \end{aligned}$$

P(employment) represents the probability that the employment status of an individual is equal to one, in other words, the likelihood of being employed. The coefficient β_0 describes a constant term and the u represents the error term. Dummy variables *university_ education* and *lower_ education* determines the level of education of individual and their estimates are crucial for our investigation. Following Nunez and Livanos (2010), the based group is chosen due to size. The largest categories are chosen to be in a base group. In the case of an education level, the *secondary_ educationn* is the based group. All computations were performed using the R software 4.3.4..

4.1.2 The country specific models

To capture and compare the impact of higher education within the specific Visegrad countries, we divided our sample into four sub-samples, each sub-sample is describing a particular country from the Visegrad region.

Models for all countries are the same, but the sample, as well as the number of observations, vary. Our data provide 1977 observations for Hungary,

1876 observations for Poland, 1796 observations for the Slovak Republic and 1765 observations for the Czech Republic.

Based on the mentioned methodology, data provided and previous literature, the following model is presented:

$$\begin{aligned} P(employment) = \Lambda(&\beta_0 + \beta_1 university\_education + \beta_2 lower\_education \\ &+ \beta_3 age\_15\text{–}24 + \beta_4 age\_25\text{–}34 + \beta_5 age\_35\text{–}44 \\ &+ \beta_6 age\_55plus + \beta_7 student + \beta_8 retired \\ &+ \beta_9 house + \beta_{10} male + \beta_{11} minor + \beta_{12} big\_city + \beta_{13} village \\ &+ \beta_{14} live\_partner + u) \end{aligned}$$

All computations were performed using the R software 4.3.4..

4.1.3 The bachelor's degree versus master's degree model

The last model studies the additional value of achieving postgraduate (Master's) degree in contrast with first (Bachelor's) degree. Control variables are exactly same as in the first model (The overall effect of a university degree in the Visegrad area). However, the variable *university education* is divided into variables *Bachelor's degree* and *Master's degree*.

Based on the mentioned methodology, data provided and previous literature, the following model is presented:

$$\begin{aligned} P(employment) = \Lambda(&\beta_0 + \beta_1 bachelor's\_degree + \beta_2 master's\_degree \\ &+ \beta_3 lower\_education + \beta_4 CZ + \beta_5 SK + \beta_6 PL \\ &+ \beta_7 age\_15\text{–}24 + \beta_8 age\_25\text{–}34 + \beta_9 age\_35\text{–}44 + \beta_{10} age\_55plus \\ &+ \beta_{11} student + \beta_{12} retired + \beta_{13} house + \beta_{14} male \\ &+ \beta_{15} minor + \beta_{16} big\_city + \beta_{17} village + \beta_{18} live\_partner + u) \end{aligned}$$

All computations were performed using the R software 4.3.4..

4.2 Goodness of fit

The strength of all models is identified by two methods. Since R-squared is not suitable to explain variability in the dependent variable in the non-linear model (Wooldridge, 2015), McFadden pseudo R-squared is computed (R-squared $= 1 - logL_0/logL_{ur}$) where $logL_0$ is the log-likelihood of trivial model and $logL_{ur}$ is the log-likelihood of unrestricted model.

According to McFadden, a model is considered to be great fitted when the values of pseudo R-squared statistics are between 0.2 and 0.4 (Lee, 2013) unlike R-squared, where we look for the highest possible value.

The second method, which is used to determine an accuracy of the model makes use of the Receiver Operating Characteristic (ROC) curve. ROC curve plots sensitivity[2] (true positive rate) as a function of 1 - specificity[3] (false positive rate) for various cut-off points. Each point on the curve represents a sensitivity/specificity pair. According to Zweig and Campbell (1993), when the curve is closer to the left high corner, then the accuracy of estimation is greater. Therefore, the ROC curve is frequently used to evaluate a prediction performance of different models.

The area under the ROC curve (AUC) suggests model performance quality averaged over all possible outcomes. Due to Ekelund (2008), the model quality is very high, when the size of an AUC is between 0.9 and 1.0.

4.2.1 The effect of a university degree in the Visegrad region

The strength of the first model can be described by the ROC curve and by the AUC from Figure 4.1. The AUC is equal to 0.9128 that may indicate that the performance quality of our model is very satisfying. The shape of the ROC curve from Figure 4.1 also suggests that accuracy of estimation is desirable.

[2]Probability that the result of an estimation is positive when individual is employed. According to *Evaluation: From Precision, Recall and F-Measure to ROC, Informedness, Markedness & Correlation* Powers, David M W, Journal of Machine Learning Technologies, 2011.

[3]probability that the result of an estimation is negative when individual is not employed. According to *Evaluation: From Precision, Recall and F-Measure to ROC, Informedness, Markedness & Correlation* Powers, David M W, Journal of Machine Learning Technologies, 2011.

The pseudo R-squared of the overall effect model is equal to 0.472. This value indicates that variability of the variable *employment* is not greatly described by independent variables but it is good enough. Although, when the interest of our investigation is to examine the effect between variables, the size of the pseudo R-squared is not so important.

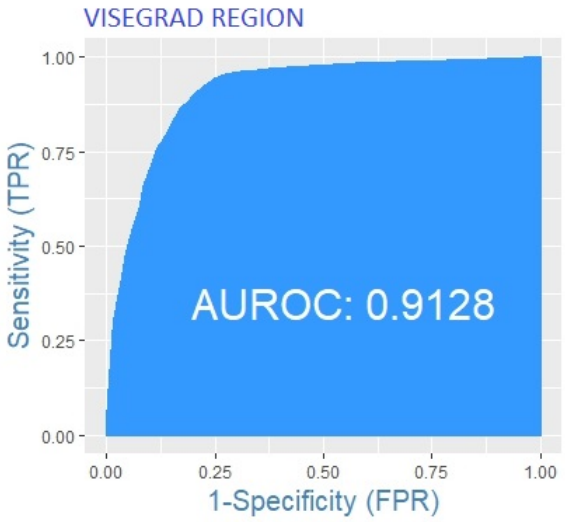

Figure 4.1: The ROC curve for the model of the effect of a university degree in the Visegrad region model.

4.2.2 The country specific models

ROC curves for all models are shown in Figure 4.2 below. The shape of the ROC curve, as well as the AUC of all country specific models, signals that the accuracy of all models are highly appropriate.

The values of the pseudo R-squared of the country specific models correspond to 0.573 for the Czech Republic, 0.481 for the Slovak Republic, 0.444 for Hungary, 0.473 for Poland. All of these values indicate that variance in the dependent variable *employment* is acceptably explained by independent variables.

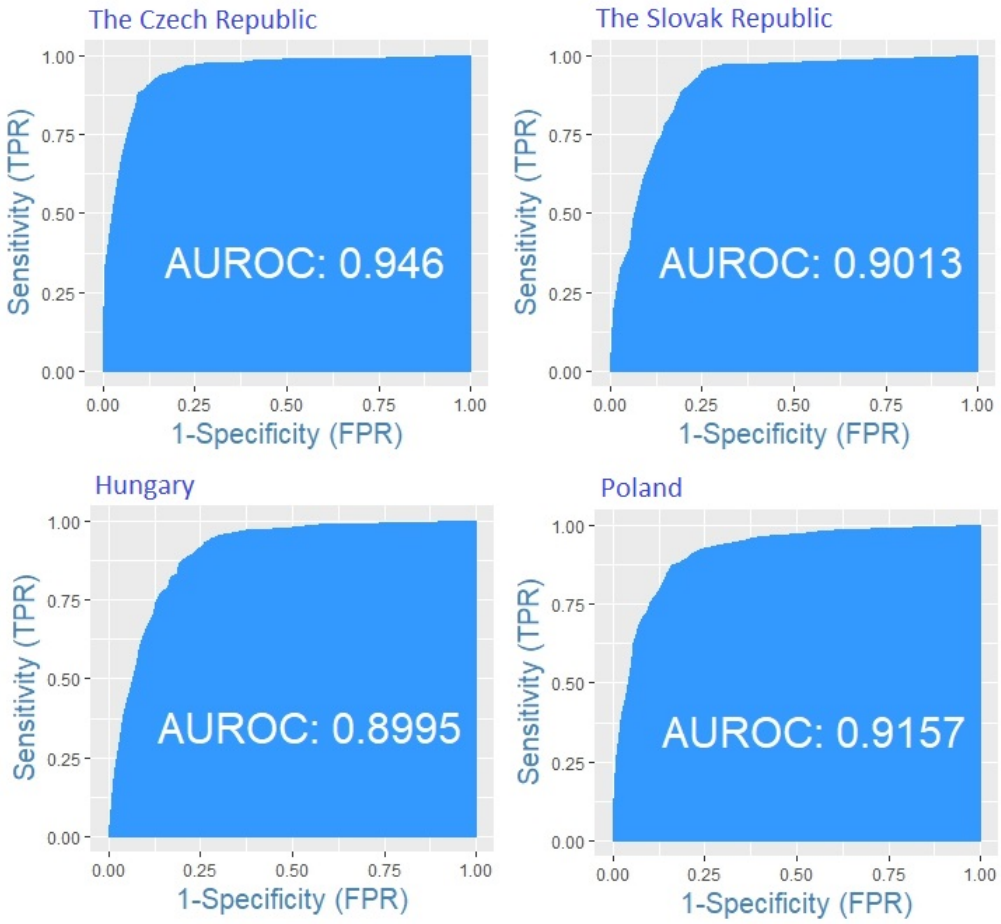

Figure 4.2: The ROC curves for country specific models.

4.2.3 The bachelor's degree versus master's degree model

Figure 4.3 describes the accuracy of the Bachelor's degree versus Master's degree model. The shape of the ROC curve demonstrates that the performance of a model is more than convenient and the value of the AUC (0.913) indicates that the accuracy of the estimation is also great.

The pseudo R-squared of the Bachelor's degree versus Master's degree model is equal to 0.472. Both the value of the AUC and the value of the pseudo R-squared are very similar to the model of an overall effect of university education. It might be caused due to the fact that this model is only a more detailed version of the first model. Following the value of the pseudo R-squared statistic, the variability of the variable *employment* is good enough

explained by independent variables. Especially when we are interested in the investigation of an effect between variables.

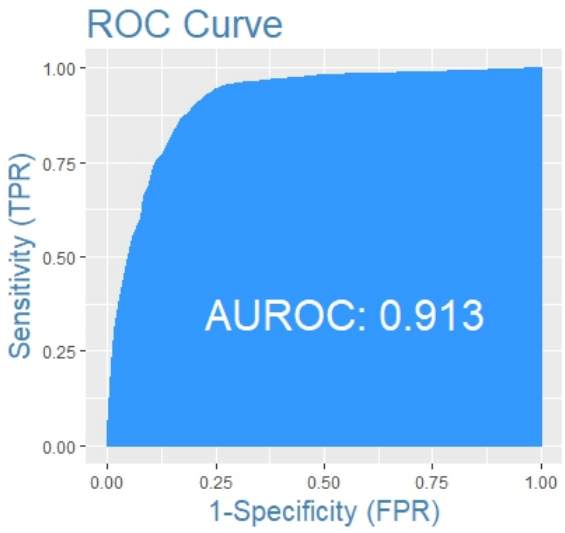

Figure 4.3: The ROC curve for the Bachelor's degree versus Master's degree model.

Chapter 5

Results

In this chapter, the results of the logit model are interpreted by using both the log-odds interpretation and the average marginal effect (AME) interpretation. Firstly, the model of an overall effect is presented. Then results from all four country-specific models are demonstrated. The final model which is interpreted is the Bachelor's degree versus Master's degree model. The inclusion of the LPM model is mainly used as a robustness check for obtained estimates.

5.1 The effect of a university degree in the Visegrad region

The coefficients presented in Table 5.1 show how a unitary increase in explanatory variables affects the variable *employment*.

	Logit model	AME model	LPM
(Intercept)	1.30^{***}		0.75^{***}
	(0.10)		(0.02)
university_educaiton	0.87^{***}	0.10^{***}	0.11^{***}
	(0.08)	(0.01)	(0.01)
lower_eduction	-1.51^{***}	-0.20^{***}	-0.16^{***}
	(0.08)	(0.02)	(0.01)
CZ	0.10	0.01	0.01
	(0.08)	(0.01)	(0.01)
SK	$-0.15^{\bullet}$	-0.02	-0.02

	(0.08)	(0.01)	(0.01)
PL	0.17^{*}	0.02	$0.02^{\bullet}$
	(0.07)	(0.01)	(0.01)
age_15_24	-0.85^{***}	-0.11^{***}	-0.19^{***}
	(0.10)	(0.02)	(0.03)
age_35_44	0.71^{***}	0.08^{***}	0.10^{***}
	(0.09)	(0.01)	(0.02)
age_45_54	0.49^{***}	0.06^{***}	0.07^{***}
	(0.09)	(0.01)	(0.02)
age_55_plus	-0.13	-0.01	-0.02
	(0.09)	(0.01)	(0.02)
student	-2.14^{***}	-0.29^{***}	-0.39^{***}
	(0.10)	(0.02)	(0.03)
retired	-3.97^{***}	-0.60^{***}	-0.63^{***}
	(0.10)	(0.01)	(0.02)
house	-1.18^{***}	-0.14^{***}	-0.16^{***}
	(0.07)	(0.01)	(0.01)
male	0.46^{***}	0.05^{***}	0.05^{***}
	(0.06)	(0.01)	(0.01)
minor	-0.78^{***}	-0.09^{***}	-0.15^{***}
	(0.13)	(0.02)	(0.03)
big_city	0.22^{**}	0.02^{*}	0.02^{*}
	(0.07)	(0.01)	(0.01)
village	0.01	0.00	0.00
	(0.06)	(0.01)	(0.01)
live_partner	-0.33^{***}	-0.04^{***}	-0.02^{*}
	(0.06)	(0.01)	(0.01)
Num. obs.	7412	7412	7412
Pseudo R-squared	0.472		
Adjusted R-quared			0.532

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\bullet}p < 0.1$

Table 5.1: The summary of the effect of a university degree in the Visegrad region model.

The estimates obtained from the logit model correspond to the log-odds estimates. Marginal effects are estimates of both AME model and LPM. The significance of all variables in the logit model is determined by the LR

test. Standard errors shown in the brackets of the AME model and LPM are robust standard errors. Variables demonstrating the level of education are the most important for our investigation. From the Table 5.1 is visible that both the *university education* and the *lower education* are significant.

In terms of short-time unemployment, Log-odds estimates indicate that individuals who completed university education have 89 percent higher chance of being employed compared to those who finished only secondary education (control group). This discovery suggests that position on the labour market is significantly better for higher educated workers in the Visegrad region. Nunez and Livanos (2010) and Oancea et al. (2016) conducted similar research. Although they focused on the different areas (EU-15 respectively Romania), the log-odds estimates of having higher education from both mentioned studies are comparable with the findings of this research. Nevertheless, Nunez and Livanos (2010) claims that individuals who finished only lower education have a better position in the labour market compared to the those who achieved secondary education. They believe that the reason is that workers with only lower education have a lower reservation wage[1] and are willing to accept any job rather than be unemployed.

Gender unemployment gap in the European labour market was authenticated by Bakas and Papapetrou (2014). Hence, interpreting estimator of the variable *male* is very important for our investigation. According to log-odds interpretation, a male has 46 percent higher chance of finding a job compared to a female. This finding is comparable to investigations of other researchers (e.g., Nunez and Livanos (2010), Oancea et al. (2016)).

The estimators obtained from both the AME model and the linear probability model exposes the marginal effects of our variables. Coefficients of regressions refer to the percentage points change in likelihood to be employed. The results from the LPM are considerably similar to results interpreted via the average marginal effect. For the purpose of this research, the main focus is on the AME interpretation of the logit regression. The LPM is mostly

[1] In labor economics, the reservation wage is the lowest wage rate at which a worker would be willing to accept a particular type of job.

included to compare and verify results.

According to our data, the results from the AME model indicate that completing tertiary education improve the probability of being employed by 10 percentage points, in contrast with completing only secondary education. Comparing this value with OECD (2017) data which are demonstrated in Figure 1.4 (see chapter The employment and education in the Visegrad region), we can consider this result not to be surprising. In the year 2012, the employment rate for people who achieved tertiary education was 12 percentage points higher in contrast to the employment rate of those who has completed secondary education.

The difference in employability between individuals who have completed only lower levels of education and those who have achieved secondary education is more significant. Based on our estimation, lower educated population suffers by approximately 20 percentage points lower probability of being employed compared to the secondary educated population. This discovery can additionally confirm the statement from the *What are the advantages today of having an upper secondary qualification?* (2015) article that upper-secondary (post-secondary) education is the threshold for a better position in the labour market.

Gender or age may be other factors which influence the likelihood of being employed. Our results suggest that male has 5 percentage points higher chance of participation in the labour market compared to female. The population who have between 35-44 years of age might have the best opportunity of being employed compared to the control group (from 25-34 years of age).

5.2 The country specific models

Following models describe the impact of university education in all Visegrad countries separately. Table 5.2 below displays coefficients for the logit regression. LPM model is demonstrated in Appendix C.

	CZ 1	CZ 2	SK 1	SK 2	HU 1	HU 2	PL 1	PL 2
(Intercept)	2.29^{***}		1.22^{***}		1.37^{***}		1.00^{***}	
	(0.26)		(0.22)		(0.21)		(0.23)	
university_educ.	$0.43^{\bullet}$	0.03	0.54^{*}	0.05^{*}	0.67^{***}	0.08^{***}	1.31^{***}	0.15^{***}
	(0.26)	(0.02)	(0.22)	(0.03)	(0.20)	(0.02)	(0.19)	(0.02)
lower_educ.	-2.08^{***}	-0.23^{***}	-1.57^{***}	-0.20^{***}	-1.42^{***}	-0.20^{***}	-1.23^{***}	-0.15^{***}
	(0.28)	(0.04)	(0.22)	(0.04)	(0.17)	(0.03)	(0.23)	(0.03)
age_15_24	-0.32	-0.03	-0.76^{**}	-0.09^{*}	-0.60^{*}	-0.08^{*}	-1.09^{***}	-0.14^{***}
	(0.35)	(0.05)	(0.25)	(0.04)	(0.24)	(0.03)	(0.26)	(0.04)
age_35_44	0.26	0.02	0.69^{**}	0.07^{**}	0.38	0.05	1.14^{***}	0.13^{***}
	(0.27)	(0.02)	(0.22)	(0.02)	(0.20)	(0.03)	(0.25)	(0.03)
age_45_54	0.06	0.00	0.49^{*}	0.05	0.13	0.02	0.83^{***}	0.10^{***}
	(0.28)	(0.02)	(0.21)	(0.03)	(0.20)	(0.03)	(0.23)	(0.03)
age_55_plus	-0.13	-0.01	0.03	0.00	-0.25	-0.03	-0.22	-0.03
	(0.29)	(0.03)	(0.24)	(0.03)	(0.22)	(0.03)	(0.24)	(0.03)
student	-3.59^{***}	-0.45^{***}	-3.11^{***}	-0.40^{***}	-2.80^{***}	-0.39^{***}	-1.35^{***}	-0.17^{***}
	(0.35)	(0.06)	(0.33)	(0.04)	(0.29)	(0.03)	(0.23)	(0.03)
retired	-4.81^{***}	-0.68^{***}	-4.64^{***}	-0.66^{***}	-3.93^{***}	-0.58^{***}	-3.54^{***}	-0.53^{***}
	(0.30)	(0.03)	(0.33)	(0.03)	(0.26)	(0.02)	(0.24)	(0.03)
house	-2.63^{***}	-0.30^{***}	-1.02^{***}	-0.12^{***}	-0.61^{***}	-0.08^{***}	-1.26^{***}	-0.15^{***}
	(0.24)	(0.04)	(0.17)	(0.03)	(0.15)	(0.02)	(0.19)	(0.02)
male	0.47^{**}	0.04^{*}	0.40^{**}	0.04^{*}	0.30^{*}	0.04^{*}	0.69^{***}	0.08^{***}
	(0.17)	(0.02)	(0.15)	(0.02)	(0.14)	(0.02)	(0.15)	(0.02)
minor	-0.74	-0.07	-1.31^{***}	-0.16^{***}	-1.04^{***}	-0.14^{***}	0.42	0.05
	(0.47)	(0.05)	(0.31)	(0.05)	(0.26)	(0.04)	(0.53)	(0.06)
big_city	0.25	0.02	0.42	0.04	0.31	0.04	0.12	0.01
	(0.21)	(0.02)	(0.22)	(0.03)	(0.17)	(0.02)	(0.19)	(0.02)
village	-0.31	-0.03	-0.06	-0.01	-0.16	-0.02	0.24	0.03
	(0.19)	(0.02)	(0.16)	(0.02)	(0.15)	(0.02)	(0.16)	(0.02)
live_partner	-0.46^{*}	-0.04	-0.13	-0.01	-0.19	-0.02	-0.51^{**}	-0.06^{**}
	(0.21)	(0.02)	(0.18)	(0.02)	(0.14)	(0.02)	(0.17)	(0.02)
Num. obs.	1765		1794		1977		1876	
Pseudo R-squared	0.573		0.481		0.444		0.473	

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\bullet}p < 0.1$

Table 5.2: The summary of the country specific models

Model labelled as number one represents the logit model interpreted with the log-odds estimates and model labelled as number two shows the average marginal effect estimates of the logit model.

The significance of our variables is detected by the LR test. From Table 5.1 is noticeable that variables describing the level of education are statistically significant at least at the one percent level. Standard errors in brackets under the AME coefficients are robust standard errors.

Results from the first model indicate that higher education is positively

correlated with the probability of being employed. Purpose of this part of our investigation is to show differences between countries of the Visegrad region by estimating models on an individual country subset.

According to the log-odds estimates, university graduates in Poland have the best position in the labour market in comparison with individuals who completed only secondary education. They have a 131 percent higher chance of success when are tertiary educated, in terms of increase in odds ratio. The effect of a university degree on employability is relatively similar for all other Visegrad group countries. The Czech Republic records the lowest increase in the chance of being employed in case of achieving a university degree, in comparison with those who has completed only secondary education. Czech graduates experience a 43 percent increase in a chance to be employed, Slovak graduates 54 percent improvement and graduates from Hungary increase their position by 67 percent. The AME model estimates suggest a similar order of examined countries.

According to the OECD (2017) data presented in Figure 5.1 below, Poland is one of the OECD countries where the difference between the employability of secondary educated individuals and the university educated individuals is very significant. On the other side of a spectrum, in the Czech Republic is almost negligible difference between secondary and university educated population. Many factors influence the position of a graduate in the labor market. For instance, the Czech Republic records very low values of the unemployment rate OECD (2018). Therefore, a transition of new graduates can be more difficult due to the lower demand for new workers.

Another important point to mention is that the employment rate varies across fields of study (OECD, 2017). Some fields as Medical studies or Engineering belongs to fields with the highest employability, at the opposite side are fields as Humanities and Arts or Biology and Environment (Nunez and Livanos, 2010). Hence the performance of a country might be weakened by the fact that there exist a surplus of individuals who graduated in a field which is not so popular in the labour market (Abel et al., 2014).

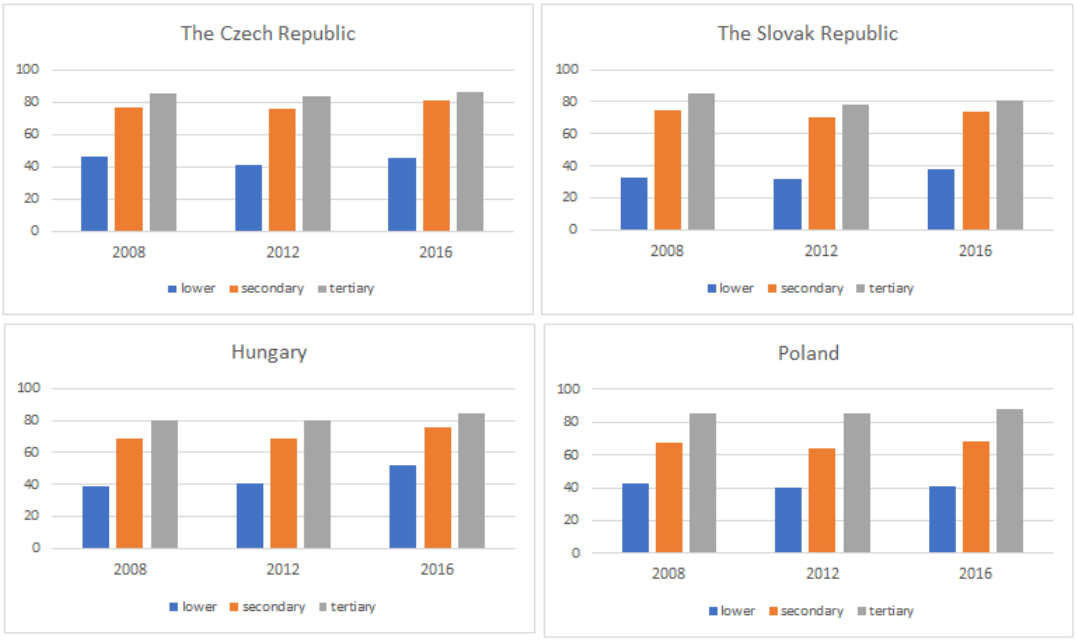

Figure 5.1: Employment rates of individuals between 25-64 years of age in the Visegrad group countries, by educational level (OECD, 2017).

Another control variable which may affect the probability of being employed can be *male*. The estimators of the variable *male* indicate that gender differences are not very significant for almost all Visegrad countries. Despite Poland, where men have 8 percentage points higher probability of being employed compared to women, all other countries have only 4 percentage points difference between men and women in favour of men.

5.3 The Bachelor's degree versus Master's degree model

The following model is estimated to study the additional value of completing different levels of tertiary education.

	Logit model	AME model	LPM
(Intercept)	1.30^{***}		0.75^{***}
	(0.10)		(0.02)
Bachelor's degree	0.79^{***}	0.08^{***}	0.10^{***}
	(0.12)	(0.02)	(0.02)
Master's degree	0.93^{***}	0.10^{***}	0.11^{***}
	(0.09)	(0.01)	(0.01)

lower_education	-1.51^{***}	-0.20^{***}	-0.16^{***}
	(0.08)	(0.02)	(0.01)
CZ	0.09	0.01	0.01
	(0.08)	(0.01)	(0.01)
SK	-0.17^{*}	-0.02	-0.02
	(0.08)	(0.01)	(0.01)
PL	0.16^{*}	0.02	0.02
	(0.07)	(0.01)	(0.01)
age_15_24	-0.84^{***}	-0.10^{***}	-0.19^{***}
	(0.10)	(0.02)	(0.03)
age_35_44	0.71^{***}	0.08^{***}	0.10^{***}
	(0.09)	(0.01)	(0.02)
age_45_54	0.50^{***}	0.06^{***}	0.07^{***}
	(0.09)	(0.01)	(0.02)
age_55_plus	-0.13	-0.01	-0.02
	(0.09)	(0.01)	(0.02)
student	-2.13^{***}	-0.29^{***}	-0.39^{***}
	(0.10)	(0.02)	(0.03)
retired	-3.97^{***}	-0.60^{***}	-0.63^{***}
	(0.10)	(0.01)	(0.02)
house	-1.18^{***}	-0.14^{***}	-0.16^{***}
	(0.07)	(0.01)	(0.01)
male	0.46^{***}	0.05^{***}	0.05^{***}
	(0.06)	(0.01)	(0.01)
minor	-0.78^{***}	-0.09^{***}	-0.15^{***}
	(0.13)	(0.02)	(0.03)
big_city	0.22^{**}	0.02^{*}	0.02^{*}
	(0.07)	(0.01)	(0.01)
village	0.01	0.00	0.00
	(0.06)	(0.01)	(0.01)
live_partner	-0.33^{***}	-0.04^{***}	-0.02^{*}
	(0.06)	(0.01)	(0.01)
Num. obs.	7412	741	7412
Pseudo R-squared	0.472		
Adjusted R-squared			0.532

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\bullet}p < 0.1$

Table 5.3: The summary of the Bachelor's degree versus Master's degree model.

Considering the population of the Visegrad region, individuals who finished only secondary education have 79 percent lower chance of being employed compared to graduates with Bachelor's degree, and 93 percent lower chance in comparison with graduates with Master's degree. Albeit the additional value of completing a Master's degree was found, the impact of the additional level of tertiary education appears to be diminishing.

Due to data from OECD (2017), the additional value of achieving Master's degree is 6.25 percentage points at the Visegrad group average. Difference between the AME estimators of Master's degree and Bachelor's degree from our regression is only 2 percentage points. The cause of this significant difference can be explained by the fact that data from OECD (2017) works only with population between 25-64 years of age and this paper works with population which age is 15 years and more. Therefore, there may be a number of people who achieved Master's degree and are not willing to find a job.

Conclusion

The purpose of this thesis was to study whether those with completed tertiary education have a greater chance to be successful in the labour market in comparison with those who have not obtained a university degree. This problem is very popular across various studies. Hence, there exists a strong evidence which confirms the fact that people who have achieve higher educational level are more likely to be employed as opposed to those with lower levels of achieved education. (e.g. Nickell (1979), Lauer (2003), Nunez and Livanos (2010)). However, no relevant study has yet been conducted to investigate the effect of tertiary education on employability in the Visegrad group countries.

The study presented in this thesis examines the effect of university education on employability, applying three models. The first model investigates the overall impact of higher education in the whole Visegrad region; the second model examines all countries separately; and the last model studies the additional value of completing a Master's degree instead of a Bachelor's degree.

Micro-data from the sixth round of the European Social Survey were used to reach the final result. In order to guarantee the random sample, variables *pspwght* and *pweight* were used.

The binary variable '*employment*' has been applied as the dependent variable. Therefore, the logistic (logit) function is applied to our regressions. Under a very generic assumption, the estimation via the Maximum Likelihood Estimation (MLE) is consistent, asymptotically normal and asymptotically efficient when the random sample is preserved (Wooldridge, 2015).

Additionally, the linear probability model is included mainly as a robustness check for the obtained estimates.

To interpret a logistic regression, both the average marginal effect interpretation and the log-odds interpretation were used.

The intuition from previous researches is confirmed by the results from the first model, which suggest that an individual who has completed university education has an 87 percent higher chance to be employed when compared to an individual who has has only complete the secondary education level. The AME estimate indicates 10 percentage points higher probability of being employed when an individual has completed a higher level of education. This discovery corresponds with the OECD (2017) data where the employment rate of tertiary educated population is 12 percentage points higher in comparison with secondary educated population. The additional finding from our results was that the difference between the employability of the secondary educated and lower educated population is significant. Thus, secondary education became the threshold for a successful entry into the labour market (*What are the advantages today of having an upper secondary qualification?*, 2015).

The second model compares the effect of the university education across the selected countries. People in Poland experience the greatest impact of university education; and on the contrary, the lowest impact was detected in the Czech Republic.

The inference of the third model suggests that there is an additional value of achieved the Master's degree, in comparison with the Bachelor's degree. However, the impact of the additional level of tertiary education is diminishing.

To sum up, the results of this investigation suggest that the impact of university education in the Visegrad region is significant. However, the main threshold for achieving a better position in the labour market is the completion of the secondary level of education. This may be caused by lower reservation wage, which secondary-educated workers are willing to accept.

For more detailed investigation in the future research, I suggest to study the impact of higher education on employability across the fields of study, as it has been proved that various fields have various employment rates (Abel et al., 2014).

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Appendix A

	Education	Arts and humanities	Social sciences, journalism and information	Business, administration and law	Natural sciences, mathematics and statistics	Information and communication technologies	Engineering, manufacturing and construction	Agriculture, forestry, fisheries and veterinary	Health and welfare	Services
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Australia	9	11	7	34	6	4	8	1	19	1
Austria	13	9	10	22	6	4	20	2	7	9
Belgium	9	11	11	21	4	1	12	2	27	1
Canada	6	11	16	26	7	3	12	2	15	3
Chile	15	4	4	23	1	3	16	2	21	11
Czech Republic	11	8	11	23	5	4	16	3	11	7
Denmark	9	13	10	20	5	4	11	2	22	4
Estonia	8	12	9	25	7	5	14	2	12	6
Finland	7	13	7	18	5	7	17	2	19	5
France	3	9	8	34	7	3	15	2	16	3
Germany	10	12	7	23	10	5	22	2	7	3
Greece	m	m	m	m	m	m	m	m	m	m
Hungary	16	10	10	25	4	2	16	3	8	5
Iceland	m	m	m	m	m	m	m	m	m	m
Ireland	8	13	7	24	8	6	10	2	17	5
Israel	m	m	m	m	m	m	m	m	m	m
Italy	m	m	m	m	m	m	m	m	m	m
Japan[1]	9[d]	15[d]	8[d]	20[d]	3[d]	x	18[d]	3[d]	15[d]	8[d]
Korea	7	17	5	16	5	2	22	1	14	9
Latvia	7	8	9	32	4	4	13	2	14	8
Luxembourg	16	9	7	39	4	5	5	0	15	0
Mexico	12	4	9	34	3	2	23	2	10	1
Netherlands[2]	11	9	15	28	5	2	8	1	16	5
New Zealand	10	12	9	25	6	7	8	2	15	5
Norway	16	9	11	16	5	3	13	1	20	5
Poland	14	7	[11]	24	4	3	15	2	13	8
Portugal	7	9	11	19	6	1	21	2	19	6
Slovak Republic	13	7	11	21	6	3	13	2	18	6
Slovenia	10	9	12	22	6	3	16	3	10	7
Spain	16	9	7	19	5	4	16	1	15	7
Sweden	12	6	13	18	4	4	18	1	22	2
Switzerland	10	8	7	28	7	2	15	1	15	6
Turkey	10	11	8	38	4	2	13	2	8	4
United Kingdom	10	15	12	22	13	4	9	1	13	0
United States	7	20	12	20	7	4	7	1	17	7
OECD average	10	10	10	24	6	4	14	2	15	5
EU22 average	10	10	10	24	6	4	14	2	15	5

Figure 5.2: Distribution of people who completed tertiary education by fields of study (OECD, 2017).

Appendix B

Algebraic transformation of logistic function:

$$P_i = \frac{e^z}{1 + e^z}$$

$$1 - P_i = 1 - \frac{e^z}{1 + e^z} = \frac{(1 + e^z) - e^z}{1 + e^z} = \frac{1}{1 + e^z}$$

$$\frac{P_i}{1 - P_i} = \frac{\frac{e^z}{1+e^z}}{\frac{1}{1+e^z}} = e^z = e^{(\beta_0 + \beta_1 * x_1 + \beta_2 * x_2 + ...)}$$

$$log(\frac{P_i}{1 - P_i}) = \beta_0 + \beta_1 * x_1 + \beta_2 * x_2 + ...$$

Appendix C

The following table interprets the results of the LPM from country specific models. Results serve mainly to compare and verify estimates from the logit model, and corresponding AME estimates in part 5.2. All presented standard errors are robust standard errors.

	CZ	SK	HU	PL
(Intercept)	0.87^{***}	0.73^{***}	0.76^{***}	0.72^{***}
	(0.03)	(0.04)	(0.03)	(0.03)
university_edcuation	0.04	0.06^{*}	0.09^{***}	0.16^{***}
	(0.02)	(0.03)	(0.02)	(0.02)
lower_education	-0.17^{***}	-0.16^{***}	-0.16^{***}	-0.13^{***}
	(0.03)	(0.03)	(0.02)	(0.02)
age_15_24	-0.06	-0.17^{**}	-0.12^{**}	-0.26^{***}
	(0.07)	(0.06)	(0.05)	(0.05)
age_35_44	0.04	0.11^{***}	0.07^{*}	0.14^{***}
	(0.03)	(0.03)	(0.03)	(0.03)
age_45_54	0.02	0.08^{*}	0.02	0.10^{**}
	(0.03)	(0.04)	(0.03)	(0.03)
age_55_plus	-0.01	0.01	-0.04	-0.05
	(0.04)	(0.04)	(0.04)	(0.04)
student	-0.63^{***}	-0.50^{***}	-0.48^{***}	-0.25^{***}
	(0.07)	(0.06)	(0.04)	(0.04)
retired	-0.75^{***}	-0.67^{***}	-0.60^{***}	-0.58^{***}
	(0.03)	(0.04)	(0.03)	(0.03)
house	-0.38^{***}	-0.16^{***}	-0.08^{***}	-0.17^{***}
	(0.05)	(0.03)	(0.02)	(0.03)
male	0.04^{*}	0.04^{*}	0.03	0.08^{***}
	(0.02)	(0.02)	(0.02)	(0.02)
minor	-0.17^{*}	-0.19^{***}	-0.22^{***}	0.05
	(0.08)	(0.05)	(0.04)	(0.06)

big_city	0.02	0.05	0.03	0.02
	(0.02)	(0.03)	(0.02)	(0.02)
village	−0.03	−0.00	−0.02	0.03
	(0.02)	(0.02)	(0.02)	(0.02)
live_partner	−0.02	0.01	−0.00	−0.04
	(0.02)	(0.02)	(0.02)	(0.02)

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\bullet}p < 0.1$

Table 5.4: The summary of the linear probability model of the country specific models